Dataset Expocode	**MLCE20160415**
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Dataset	**Funding Info:** NOAA Climate Program Office; NOAA Ocean Acidification Program **Initial Submission (yyyymmdd):** 20160505 **Revised Submission (yyyymmdd):** 20160914
Campaign/Cruise	**Expocode:** MLCE20160415 **Campaign/Cruise Name:** EQNX_20160415 **Campaign/Cruise Info:** AOML_SOOP_CO2 **Platform Type:** **CO2 Instrument Type:** Equilibrator-IR or CRDS or GC **Survey Type:** SOOP Line **Vessel Name:** M/V Equinox **Vessel Owner:** Royal Caribbean International **Vessel Code:** MLCE
Coverage	**Start Date (yyyymmdd):** 20160415 **End Date (yyyymmdd):** 20160429 **Westernmost Longitude:** 80.1 W **Easternmost Longitude:** 2.2 E **Northernmost Latitude:** 41.3 N **Southernmost Latitude:** 26.1 N **Port of Call:** Fort Lauderdale, FL **Port of Call:** Ponta Delgada, Azores **Port of Call:** Lisbon, Portugal **Port of Call:** Cadiz, Spain **Port of Call:** Malaga, Spain **Port of Call:** Alicante, Spain **Port of Call:** Barcelona, Spain
Variable	**Name:** xCO2_EQU_ppm **Unit:** ppm **Description:** Mole fraction of CO2 in the equilibrator headspace (dry) at equilibrator temperature (ppm)
Variable	**Name:** xCO2_ATM_ppm **Unit:** ppm **Description:** Mole fraction of CO2 measured in dry outside air (ppm)

Variable	**Name:** xCO2_ATM_interpolated_ppm **Unit:** ppm **Description:** Mole fraction of CO2 in outside air associated with each water analysis. These values are interpolated between the bracketing averaged good xCO2_ATM analyses (ppm)
Variable	**Name:** PRES_EQU_hPa **Unit:** hPa **Description:** Barometric pressure in the equilibrator headspace (hPa)
Variable	**Name:** PRES_ATM@SSP_hPa **Unit:** hPa **Description:** Barometric pressure measured outside, corrected to sea level (hPa)
Variable	**Name:** TEMP_EQU_C **Unit:** Degree C **Description:** Water temperature in equilibrator (°C)
Variable	**Name:** SST_C **Unit:** Degree C **Description:** Sea surface temperature (°C)
Variable	**Name:** SAL_permil **Unit:** ppt **Description:** Sea surface salinity on Practical Salinity Scale (o/oo)
Variable	**Name:** fCO2_SW@SST_uatm **Unit:** µatm **Description:** Fugacity of CO2 in sea water at SST and 100% humidity (µatm)
Variable	**Name:** fCO2_ATM_interpolated_uatm **Unit:** µatm **Description:** Fugacity of CO2 in air corresponding to the interpolated xCO2 at SST and 100% humidity (µatm)
Variable	**Name:** dfCO2_uatm **Unit:** µatm **Description:** Sea water fCO2 minus interpolated air fCO2 (µatm)
Variable	**Name:** WOCE_QC_FLAG **Unit:** None **Description:** Quality control flag for fCO2 values (2=good, 3=questionable)
Variable	**Name:** QC_SUBFLAG **Unit:** None **Description:** Quality control subflag for fCO2 values, provides explanation when QC flag=3
Sea Surface Temperature	**Location:** In Bow Thruster room, about 1m after the intake which is directly through the ship's hull, before the SW pump. **Manufacturer:** Seabird, Inc. **Model:** SBE 38 **Accuracy:** 0.001 (°C if units not given) **Precision:** 0.0003 (°C if units not given) **Calibration:** Factory calibration **Comments:** Manufacturer's Resolution is taken as Precision; Maintained by University of Miami's MTG group.
Sea Surface Salinity	**Location:** Next to the pCO2 System.

Manufacturer: Seabird
Model: SBE 45
Accuracy: ± 0.005 o/oo
Precision: 0.0002 o/oo
Calibration: Factory calibration
Comments: Manufacturer's Resolution is taken as Precision; Maintained by University of Miami's MTG group.

Atmospheric Pressure

Location: At the base of the radar mast, 48 meter above sea level.
Normalized to Sea Level: no
Manufacturer: Vaisala
Model: WXT520
Accuracy: ± 0.5 hPa (hPa if units not given)
Precision: 0.1 hPa (hPa if units not given)
Calibration: Factory Calibration
Comments: Manufacturer's Resolution is taken as Precision; Maintained by University of Miami's MTG group.

Atmospheric CO2

Measured/Frequency: Yes, 5 readings in a group every 5 hours.
Intake Location: At forward-most, grated opening in the starboard hull on the mooring deck, which is 12 meters above sea level.
Drying Method: Gas stream passes through a thermoelectric condenser (~5 °C) and then through a Perma Pure (Nafion) dryer before reaching the analyzer (90% dry).
Atmospheric CO2 Accuracy: ± 0.5 µatm in fCO2_ATM
Atmospheric CO2 Precision: ± 0.01 µatm in fCO2_ATM

Aqueous CO2 Equilibrator Design

System Manufacturer:
Intake Depth: 5 meters
Intake Location: Bow
Equilibration Type: Spray head above dynamic pool, with thermal jacket
Equilibrator Volume (L): 0.95 L (0.4 L water, 0.55 L headspace)
Headspace Gas Flow Rate (ml/min): 70 - 150 ml/min
Equilibrator Water Flow Rate (L/min): 1.5 - 2.0 L/min
Equilibrator Vented: Yes
Equilibration Comments: Primary equilibrator is vented through a secondary equilibrator.
Drying Method: Gas stream passes through a thermoelectric condenser (~5 °C) and then through a Perma Pure (Nafion) dryer before reaching the analyzer (90% dry).

Aqueous CO2 Sensor Details

Measurement Method: IR
Method details: details of CO2 sensing (not required)
Manufacturer: LI-COR
Model: 6262
Measured CO2 Values: xCO2(dry)
Measurement Frequency: Every 140 seconds, except during calibration
Aqueous CO2 Accuracy: ± 2 µatm in fCO2_SW
Aqueous CO2 Precision: ± 0.01 µatm in fCO2_SW
Sensor Calibrations:
Calibration of Calibration Gases: The analyzer is calibrated every 5 hours with field standards that in turn were calibrated with primary standards that are directly traceable to the WMO scale. The zero gas is ultra-high purity air.
Number Non-Zero Gas Standards: 4

Calibration Gases:

Std 1: CA05585, 280.18 ppm, owned by ESRL, used every ~5.0 hours.
Std 2: CA06368, 328.12 ppm, owned by ESRL, used every ~5.0 hours.
Std 3: CA05979, 381.89 ppm, owned by AOML, used every ~5.0 hours.
Std 4: CB08988, 455.60 ppm, owned by ESRL, used every ~5.0 hours.
Std 5: 0.00 ppm, owned by AOML, used every ~25.5 hours.
Comparison to Other CO2 Analyses:
Comments:
Method Reference:
Pierrot, D., C. Neil, K. Sullivan, R. Castle, R. Wanninkhof, H. Lueger, T. Johannessen, A. Olsen, R. A. Feely, and C. E. Cosca (2009), Recommendations for autonomous underway pCO2 measuring systems and data reduction routines, Deep-Sea Res II, 56, 512-522.

Equilibrator Temperature Sensor

Location: Inserted into equilibrator ~5 cm below water level
Manufacturer: Hart
Model: 1523
Accuracy: 0.015 (°C if units not given)
Precision: 0.001 (°C if units not given)
Calibration: Factory calibration
Comments: Resolution is taken as Precision.

Equilibrator Pressure Sensor

Location: Attached to equilibrator headspace. The differential pressure reading from Setra 239, which is attached to the equilibrator headspace, is added to the pressure reading from the LICOR analyzer, which is measured by an external Setra 270 connected to the exit of the analyzer.
Manufacturer: Setra
Model: 270
Accuracy: 0.15 (hPa if units not given)
Precision: 0.015 (hPa if units not given)
Calibration: Factory calibration
Comments: Manufacturer's Resolution is taken as Precision.

Additional Information

Suggested QC flag from Data Provider: NA
Additional Comments: The analytical system operated well during this cruise. A new sensor for atmospheric pressure was connected to the analytical system two days after departure. The offset between the atmospheric and LICOR pressures (6.4 +/-0.3 mbar, n>3100) was used to estimate the first two days of atmospheric pressure. For most of 16 and 17 April the sea water flow was very variable, likely due to sea state, which eliminated many analyses. Original Data Location: http://www.aoml.noaa.gov/ocd/ocdweb/equinox/equinox_introduction.html
Citation for this Dataset:
Other References for this Dataset: